

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference OM-1670 PCT	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/US 02/ 07430	International filing date (day/month/year) 11/03/2002	(Earliest) Priority Date (day/month/year) 15/03/2001
Applicant OAK-MITSUI, INC.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 03 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☒ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 02/07430

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H05K3/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 203 955 A (GOLDBERG MARTIN J ET AL) 20 April 1993 (1993-04-20) column 17; claims 1-18	1-10, 27-32, 35
X	US 5 208 067 A (JONES CAROL R ET AL) 4 May 1993 (1993-05-04) the whole document	1, 27, 35
A		2-26, 28-34, 36-42

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

7 November 2002

Date of mailing of the international search report

14/11/2002

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Van Reeth, K

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 02/07430

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5203955	A	20-04-1993	US 5242713 A	07-09-1993
			BR 8906690 A	11-09-1990
			CA 1335340 A1	25-04-1995
			DE 68916523 D1	04-08-1994
			DE 68916523 T2	02-02-1995
			EP 0374487 A2	27-06-1990
			JP 6322547 A	22-11-1994
			JP 7084531 B	13-09-1995
			JP 2190475 A	26-07-1990
			JP 2699311 B2	19-01-1998
			US 5462628 A	31-10-1995
			US 5135779 A	04-08-1992
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US 5208067	A	04-05-1993	US 4908094 A	13-03-1990
			US 5039569 A	13-08-1991
			US 4715941 A	29-12-1987
			DE 3780676 D1	03-09-1992
			DE 3780676 T2	11-03-1993
			EP 0241739 A1	21-10-1987
			JP 1707933 C	27-10-1992
			JP 3077221 B	09-12-1991
			JP 62243627 A	24-10-1987
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PATENT COOPERATION TREATY

FILE COPY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
ROBERTS S. RICHARD
ROBERTS & MERCANTI, LLP
P.O. BOX 484
PRINCETON, NJ 08542-0484

PCT

WRITTEN OPINION

(PCT Rule 66)

Applicant's or agent's file reference OM-1670 PCT		Date of Mailing (day/month/year) REPLY DUE within 2 months/days from the above date of mailing
International application No. PCT/US02/07430	International filing date (day/month/year) 11 March 2002 (11.03.2002)	Priority date (day/month/year) 15 March 2001 (15.03.2001)
International Patent Classification (IPC) or both national classification and IPC IPC(7): H05K 1/09, 13/00 and US Cl.: 174/255,256,258; 216/13, 20, 33-35, 41, 49, 67, 83, 100, 102, 105, 106, 108		
Applicant OAK-MITSUI, INC.		

1. This written opinion is the first (first, etc.) drawn by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
 - I ☒ Basis of the opinion
 - II ☐ Priority
 - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV ☐ Lack of unity of invention
 - V ☒ Reasoned statement under Rule 66.2 (a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain documents cited
 - VII ☐ Certain defects in the international application
 - VIII ☐ Certain observations on the international application
3. The applicant is hereby **invited to reply** to this opinion.

When? See the time limit indicated above. ~~The applicant may, before the expiration of that time limit, request this Authority to grant an extension. See rule 66.2(d).~~

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 15 July 2003 (15.07.2003).

Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703)305-3230	Authorized officer <i>Anita K. Alanko</i> Anita K Alanko Telephone No. 703-308-0661 <div style="text-align: right; margin-top: 10px;">8/10/03</div>
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WRITTEN OPINION

International application No.

PCT/US02/07430

FILE COPY

I. Basis of the opinion

1. With regard to the **elements** of the international application:*

- ☒ the international application as originally filed
- ☒ the description:
 - pages 1-18, as originally filed
 - pages NONE, filed with the demand
 - pages NONE, filed with the letter of _____.
- ☒ the claims:
 - pages 19-24, as originally filed
 - pages NONE, as amended (together with any statement) under Article 19
 - pages NONE, filed with the demand
 - pages NONE, filed with the letter of _____.
- ☐ the drawings:
 - pages NONE, as originally filed
 - pages NONE, filed with the demand
 - pages NONE, filed with the letter of _____.
- ☐ the sequence listing part of the description:
 - pages NONE, as originally filed
 - pages NONE, filed with the demand
 - pages NONE, filed with the letter of _____.

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the written opinion was drawn on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages NONE
- ☐ the claims, Nos. NONE
- ☐ the drawings, sheets/~~fig~~ NONE

5. ☐ This opinion has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed."

WRITTEN OPINION

International application No.
PCT/US02/07430

FILE COPY

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims <u>1-26, 35-42</u>	YES
	Claims <u>27-34</u>	NO
Inventive Step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1-42</u>	NO
Industrial Applicability (IA)	Claims <u>1-42</u>	YES
	Claims <u>NONE</u>	NO

2. CITATIONS AND EXPLANATIONS

Please See Continuation Sheet

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

TIME LIMIT:

The time limit set for response to a Written Opinion may not be extended. 37 CFR 1.484(d). Any response received after the expiration of the time limit set in the Written Opinion will not be considered in preparing the International Preliminary Examination Report.

V. 2. Citations and Explanations:

Claims 1-16, 20-26, 35-42 lack an inventive step under PCT Article 33(3) as being obvious over E.I. Dupont de Nemours and Co. (EP 0488066 A1) in view of Suzuki et al (US 5,234,522 A).

EP 0488066 A1 discloses a process comprising:

- a) providing a polymeric substrate (polyimide to which adhesive coated copper foil is to be laminated, page 12, lines 30-31);
- b) coating a first polymeric film (the oligoimide adhesive) onto a surface of a metal foil (copper foil, page 12, lines 12-17, 30-31);
- c) laminating the first polymeric film onto the substrate by:
 - i.) laminating the first polymeric film directly onto the surface of the substrate, or
 - ii.) laminating the first polymeric film onto the substrate via an intermediate second polymeric film (the adhesive of the adhesive coated dielectric polyimide film, page 12, lines 30-31).

EP 0488066 A1 does not disclose to etch the surface of the polymeric surface prior to laminating, i.e., EP 0488066 A1 does not disclose to laminate the first polymeric film directly onto at least one *etched* surface of the substrate.

Suzuki teaches that it is useful to etch the surface of a polymeric substrate (polyimide, col.3, lines 1-8) in order to improve the adhering property to a polyimide adhesive layer (which encompasses oligoimide adhesives). It would have been obvious to one with ordinary skill in the art to etch the polymeric substrate in the method of EP 0488066 A1 prior to laminating because Suzuki teaches that this is useful in order to improve adhesion. The modified method of EP 0488066 A1 encompasses then laminating the first polymeric film directly onto at least one etched surface of the substrate, or via an intermediate second polymeric film.

As to claim 4, EP 0488066 A1 does not explicitly disclose that the oligoimide adhesive and the polymeric substrate (e.g. KAPTON) are the same polymer. However, Suzuki discloses that many different types of polyimide adhesives are useful for bonding (col.4, line 1 - col.7, line 30). It would have been obvious to one with ordinary skill in the art to use the same polymer for the adhesive and the substrate in order to minimize differences in thermal expansion, and thereby minimize failures in the final product, and further because Suzuki teaches that several different polyimide adhesives are useful, for which the composition may be optimized for best results.

As to claims 5-8, EP 0488066 A1 discloses to use a substrate of polyimide (page 12, line 12), not polyester. Polyester is a well known alternative material for polyimide, for example when high temperature stability is not required and to enable more easy solution processing compared to polyimide. It would have been obvious to one with ordinary skill in the art to use polyester in the

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

modified method of EP 0488066 A1 because it is a well known polymeric substrate material.

As to claims 9-10, EP 0488066 A1 discloses that the metal foil may comprise copper, aluminum, nickel or iron (page 12, lines 15-21).

As to claim 11, EP 0488066 A1 discloses to coat the first polymeric film to a wet clearance of about 130 microns (page 17, lines 7-8). It is unclear how thick the dry film is. However, it would have been obvious to one with ordinary skill in the art to deposit the first polymeric film to the thickness cited in the modified method of EP 0488066 A1 in order to optimize the final product for the best properties.

As to claim 12, EP 0488066 A1 does not disclose the thickness of the metal foil. However, it would have been obvious to one with ordinary skill in the art to use a metal foil of the thickness cited in the modified method of EP 0488066 A1 in order to optimize the final product for the best properties.

As to claims 13-15, Suzuki discloses to etch by using an alkali treatment (col.3, lines 5-6), for which it is obvious to one with ordinary skill in the art to use NaOH or KOH since they are conventional alkali treatments.

As to claim 16, Suzuki discloses to etch by plasma etching using oxygen or tetrafluoromethane (col.3, line 13).

As to claim 20, it would have been obvious to roughen to the degree cited in order to optimize the process for best adhesion results.

As to claim 21, EP 0488066 A1 discloses to laminate by hot roll lamination (page 12, lines 32-33).

As to claims 22-26, EP 0488066 A1 discloses that double sided copper clad may be prepared (page 12, lines 28-31), for which it would have been obvious to one with ordinary skill in the art that both surfaces of the substrate are etched in order to improve adhesion on both surfaces.

Further as to claim 35, EP 0488066 A1 discloses steps (d) - (f) in that the copper foil may be etched through photoresist layers to result in circuitry (page 12, lines 47-49).

As to claim 36, EP 0488066 A1 discloses that it is useful to etch to roughen metal in order to improve adhesion to polymers (page 12, lines 23-27). It would have been obvious to one with ordinary skill in the art to roughen the surface of the metal foil prior to step (d) in order to improve adhesion to polymers as taught by EP 0488066 A1.

As to claims 37-39, it would have been obvious to roughen to the degree cited in order to optimize the product for the best adhesion.

As to claim 40, it would have been obvious to one with ordinary skill in the art to remove the photoresist since it is not needed as part of the final device.

As to claims 41-42, it would have been obvious to use acid or alkaline etching in the method of EP 0488066 A1 since they are conventional techniques for patterning metals.

Claims 1-26, 35-42 lack an inventive step under PCT Article 33(3) as being obvious over E.I. Dupont de Nemours and Co. (EP 0488066 A1) in view of Suzuki et al (US 5,234,522 A) and Jones et al (US 5,208,067 A).

The discussion of modified EP 0488066 A1 from above is repeated here.

As to claims 16-19, Suzuki discloses to etch by plasma etching using oxygen or tetrafluoromethane (col.3, line 13). Jones teaches that a combination of oxygen and tetrafluoromethane is useful for etching to roughen surfaces to improve adhesion between organic surfaces. It would have been obvious to one with ordinary skill in the art to roughen the surface as taught by Jones with oxygen and tetrafluoromethane in the method of EP 0488066 A1 because Jones teaches that it is useful for improving adhesion between organic surfaces. It would have been further obvious to use the percentage compositions cited in order to optimize the process for the best results.

Claims 27-34 lack novelty under PCT Article 33(2) as being anticipated by Viehbeck et al (US 5,203,955 A).

Viehbeck discloses a composite comprising:

a polymeric substrate having a first etched surface (col.14, lines 40-48; reduction process, col.15, lines 64-69; col.16, lines 11-60),
a first polymeric film attached to the first etched surface of the substrate (since polyimide is bonded to polyimide, col.17, lines 30-56),
and

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

a layer of a metal foil attached to an opposite side of the first polymeric film (col.18, lines 11-14, since the polyimide is circuitized, it encompasses comprising a metal foil).

As to claim 28, Viehbeck discloses that circuitized layers are stacked, which encompasses repeating the process several times (col.18, lines12-13).

As to claims 29-32, the substrate and first polymeric film comprise a polyimide and the metal film comprises copper (col.19, line 20).

As to claims 33-34, the first polymeric film has a thickness of 50 microns (col.19, line 12) and the metal foil has a thickness of 17 microns (col.19, line 29).

Claims 27-34 lack novelty under PCT Article 33(2) as being anticipated by Suzuki et al (US 5,234,522 A).

Suzuki discloses a composite comprising:

a polymeric substrate having a first etched surface (col.3, lines 1-22),

a first polyimide film attached to the first etched surface of the substrate (col.3, lines 32-33), and

a layer of a metal foil attached to an opposite side of the first polyimide film (col.7, lines 35-40, the surface bearing a circuit encompasses comprising a metal foil).

As to claims 28-30, Suzuki discloses that the composite may comprise a double-sided copper-clad polyimide film (col.8, lines 1-8).

As to claims 31-32, the metal film comprises copper (col.8, lines 1-8).

As to claims 33-34, the first polymeric film has a thickness of 40 microns (col.9, line 31) and the metal foil has a thickness of 35 microns (col.9, line 38).

----- NEW CITATIONS -----

EP 0488066 A1 (E.I. DU PONT DE NEMOURS AND COMPANY) 03 June 1992, see page 12, lines 12-52.

US 5,234,522 A (SUZUKI et al) 10 August 1993, col.3, lines 1-21.